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A NEW CRAYFISH FROM THE NASHVILLE BASIN, TENNESSEE

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The new burrowing crayfish described below was first collected from a "tributary of Stone River, 20 miles from Columbia, Tennessee" in November during the last decade of the past century by a Mr. Von Baer. The three specimens collected by him were transferred to the Smithsonian Institution from the United States Fish Commission. Thus, the existence of this crayfish has been known for approximately 75 years. There seems to be some error in the data cited above, for I have been unable to locate a "Stone River" within a 20 mile radius of Columbia. Tributaries of Stones River in Rutherford County are 30 to 35 miles east-northeast of Columbia, and it seems probable that one of them is the source from which Mr. Von Baer obtained his specimens. The original label in the container has been damaged, and the last figure in the date has been lost.

The species was rediscovered by Dr. Glenn Gentry in a boggy area along a small tributary to the Harpeth River in Cheatham County, Tennessee in April, 1968. Subsequently, he has obtained additional specimens from the area, and during April 1969, Jean E. Pugh, Daniel J. Peters, Dr. Gentry, and I obtained a series of 27 specimens in the type-locality. Additional material has been made available to me by Harold N. Mullican of the Tennessee Game and Fish Commission and by Raymond W. Bouchard.

I should like to thank Messrs. Bouchard, Gentry, Mullican, and Peters and Miss Pugh for their assistance in amassing the specimens on which this description is based. I am also

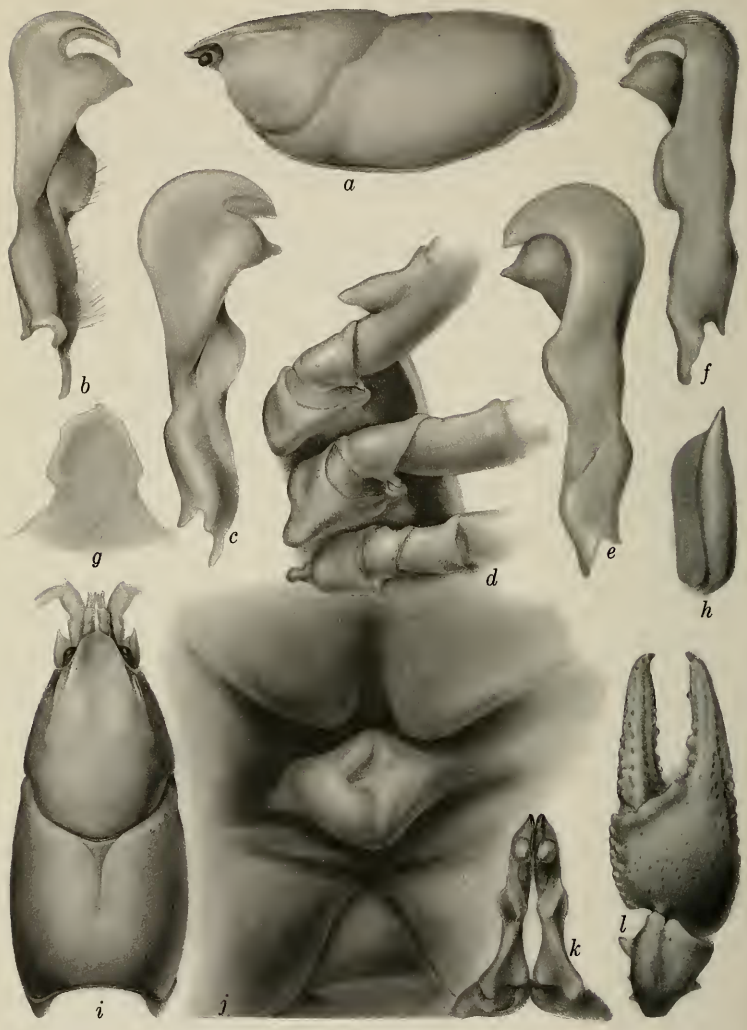

Fig. 1. *Cambarus gentryi* new species (pubescence removed from all structures illustrated except Fig. 1a). a, Lateral view of carapace of holotype. b, Mesial view of first pleopod of holotype. c, Mesial view of first pleopod of morphotype. d, Basal podomeres of third, fourth, and fifth pereiopods of holotype. e, Lateral view of first pleopod of

TABLE 1. Measurements (mm) *Cambarus gentryi.*

	Holotype	Allotype	Morphotype
Carapace:			
Height	11.7	11.3	13.1
Width	13.1	13.2	14.2
Length	27.6	26.9	30.1
Areola:			
Width	—	—	—
Length	11.5	11.2	12.8
Rostrum:			
Width	4.4	4.6	4.8
Length	4.2	3.8	5.0
Chela:			
Length of inner margin of palm	7.3	5.6	7.0
Width of palm	9.7	8.1	9.9
Length of outer margin of chela	22.1	16.8	19.7
Length of dactyl	13.2	10.0	11.6

grateful to Carolyn B. Gast for the excellent illustrations and to Fenner A. Chace, Jr. and H. H. Hobbs III for their criticisms of the manuscript.

Cambarus (*Jugicambarus*) *gentryi* new species

Diagnosis: Body pigmented, eyes small but well-developed. Rostrum with convergent margins devoid of marginal spines or tubercles, acumen very short and indistinctly delimited. Areola sublinear, comprising 40 to 44.5 percent of entire length of carapace, and bearing one or no punctations in narrowest part. Carapace without cervical tubercles or spines. Suborbital angle rounded. Postorbital ridge prominent with conspicuous swelling caudally and subtruncate cephalically. Antennal scale approximately three times longer than broad. Chela with single row of five to eight tubercles on mesial margin of palm and one to three above marginal row; lateral surface with middle half subcostate and both fingers with moderately well-developed longitudinal ridges on upper surfaces. First pleopods (Fig. 1b, f, k) of first form male with

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morphotype. f, Lateral view of first pleopod of holotype. g, Cephalic portion of epistome of holotype. h, Antennal scale of holotype. i, Dorsal view of carapace of holotype. j, Annulus ventralis of allotype. k, Caudal view of first pleopods of holotype. l, Distal podomeres of cheliped of holotype.

corneous central projection recurved approximately 120°, tapering distally, lacking subterminal notch, and not extending so far caudad as mesial process but its tip usually reaching proximally beyond distal (morphological cephalic) margin of latter; mesial process non-corneous, submammillate, with simple or spinose tip directed caudally but lying lateral to tip of central projection. Annulus ventralis (Fig. 1j) deeply embedded in sternum, and with short cephalomedian trough separated from broad caudal wall by asymmetrical median depression. Color cobalt blue with orange or yellow and yellowish green markings.

Holotypic Male, Form I: Body subcylindrical. Abdomen narrower than thorax (10.3 and 13.1 mm). Greatest width of carapace greater than depth at caudodorsal margin of cervical groove (13.1 and 11.7 mm). Areola almost linear (approximately 50 times longer than broad) with room for one punctation in narrowest part. Cephalic section of carapace 1.4 times longer than areola (length of areola 41.6 percent of entire length of carapace). Rostrum broad basally, basal width slightly greater than length, with convergent margins and short, broad, poorly-defined acumen, tip of which reaching slightly beyond midlength of penultimate podomere of antennular peduncle; margins thickened and continuous to slightly upturned tip and lacking tubercles or spines; sub-marginal row of tubercles large and deep basally but becoming smaller and shallow toward acumen; upper surface concave with few punctations basally; subrostral ridges strong and evident in lateral aspect to base of acumen. Postorbital ridges prominent although not strongly elevated, grooved dorsolaterally, with swollen prominences caudally and rounded apically. Branchiostegal spine almost obsolete, represented by very small ridge. Carapace punctate dorsally and granulate laterally; cephalic portion of hepatic region and ventral margin of cephalic portion of cervical groove with number of moderately large tubercles; cervical spines absent, represented by one or two very small squamous tubercles; gastric area with submedian pair of prominent knobs approximately midway between caudal ends of post-orbital ridges and cervical groove. Abdomen shorter and narrower than carapace (24.6 and 27.6 mm; 10.3 and 13.1 mm). Cephalic section of telson with single fixed spine in each caudolateral corner. Upper surface of telson and uropods setose. Basal podomeres and inner ramus of uropod without spines; outer ramus with row of short spines on distal margin of proximal segment, otherwise spineless.

Cephalomedian projecting portion of epistome (Fig. 1g) narrower than long, subrhomboidal, with cephalic margin arched and bearing small cephalomedian projection; basal area with fovea almost obsolete and with thickened caudal margin bearing broad concavity. Basal segment of peduncle of dextral antennule with small spine near distal margin, sinistral member without such spine. Antennae broken but probably reaching no farther caudad than midlength of abdomen. Antennal scale (Fig. 1h) almost three times longer than broad, broadest

near midlength with broadest lamellar area subequal in width to thickened lateral portion, latter terminating in heavy spine reaching end of penultimate podomere of antennular peduncle. Third maxillipeds reaching midlength of penultimate podomere of antenna.

Right chela (Fig. 1l) subrectangular, somewhat depressed but with inflated palm and with lateral margin subcostate. Upper surface of palm punctate, mesial margin with subcristiform row of eight tubercles and two above row (left chela with row of six and three above); lateral margin undulating because of large punctations; lower surface punctate but with two prominent tubercles opposite articulation with dactyl. Upper surfaces of both fingers with moderately well-defined longitudinal ridges flanked by tubercles; lower surfaces punctate without distinct ridges; opposable margin of immovable finger with row of five tubercles along proximal three-fifths (third from base largest) and one on lower level at base of distal fourth, single row of minute denticles extending between fourth tubercle and corneous tip of finger; lateral surface of finger broadly rounded, polished, and with scattered punctations; opposable margin of dactyl with eight tubercles along proximal three-fourths of finger, fourth from base largest, and with single interrupted row of minute denticles extending between fifth tubercle from base and corneous tip of finger; mesial margin of dactyl tuberculate along proximal half and punctate along distal half.

Carpus of right cheliped longer than broad with deep oblique longitudinal furrow dorsally; dorsal surface punctate; mesial surface with one large acute tubercle and smaller one proximal to it; ventral surface with single prominent tubercle lateral to major tubercle on mesial surface (no prominent tubercle on ventral surface of left carpus).

Merus of right cheliped with mesial and lateral surfaces sparsely punctate; dorsodistal surface with two prominent tubercles, ventrolateral surface with row of four tubercles and ventromesial with row of eight. Only three small tubercles on ventral surface of ischium.

Hooks on ischia of third pereiopods (Fig. 1d) strong, simple, not opposed by tubercle on basis, and projecting proximally beyond distal end of latter. Coxa of fourth pereiopods with prominent, vertically disposed caudomesial protuberance and broad shelflike flange cephalic to protuberance; coxa of fifth pereiopods without prominences. Sternum deep between third, fourth, and fifth pereiopods and with prominent tufts of setae borne on ventrolateral margins.

First pleopods (Fig. 1b, f, k) symmetrical and reaching coxa of third pereiopods when abdomen is flexed. (See diagnosis for description.)

Morphotypic Male, Form II: Differs from holotype in following respects: cephalic section of telson with two spines in each caudolateral corner, mesial ones movable; mesial ramus of uropod with median ridge bearing small spine almost at distal margin of ramus; mesial margin of palm of chela with row of six tubercles and two above row; mesial surface of carpus of right cheliped with two tubercles proximal to major one;

dorsal surface of merus with only one well-developed tubercle, and ventromesial margin with row of 10 tubercles on right cheliped; hooks on ischia of third pereiopods and protuberances on coxae of fourth much reduced in size. First pleopod (Figs. 1c, e) with neither terminal element corneous and mesial process as in holotype; central projection much heavier, inflated, and contiguous with mesial process for proximal half of its length; shaft with distinct oblique suture in proximal half. (see measurements.)

Allotypic Female: Differs from holotype in following respects: telson and uropods as in morphotype; mesial margin of right chela with row of six tubercles and two above it, left with row of five and three above; carpus of right chela as in morphotype; merus of both chelae with single well-developed tubercle dorsally, ventrolateral margin with row of five on dextral cheliped and ventromesial margin with row of nine on dextral and 10 on sinistral cheliped. (See measurements.)

Annulus ventralis (Fig. 1j) about 1.4 times broader than long, deeply embedded in sternum, and firmly fused to V-shaped sternal plate immediately cephalic to it, but with caudal half movable; cephalic portion with short median longitudinal trough broadening caudally to form broad asymmetrical submedian depression; sinus originating along caudodextral wall of latter, curving to median line, then caudally, and terminating on broad caudal wall. Sternite between fifth pereiopods subtriangular and about 1.3 times broader than long.

Color Notes: Carapace with hepatic and branchiostegal areas cobalt blue; gastric region also blue but suffused with greenish tan. Margins of rostrum, postorbital ridges, pair of subcircular prominences at caudolateral ends of postorbital ridges, and paired tubercles in gastric area orange tan; pair of faint cephalomesially-directed pale tan lines extending from base of rostrum. Subrostral ridges pale cream tan; lower marginal portions of branchiostegites and lower hepatic area almost white. Cephalic terga of abdomen almost as blue as branchiostegites but fading caudally, assuming greenish suffusion; uropods and telson pale greenish blue. Caudal margin of each tergum and margins of uropods and telson with fringe of orange tan setae. Antennae cream with orange tan setae. Dorsal surface of cheliped bluish green from distal portion of merus to orange tan tips of fingers, progressively paler distally; distal articular surface of basis and ischium with orange knobs and margins; distal margin of merus, dorsal articular area of carpus, and articular surface of propodus at base of dactyl orange; all tubercles on chela yellowish cream; spines on dorsodistal portion of merus, spine on mesial surface of carpus, and mesial row of tubercles on propodus conspicuously orange-yellow; lower surface of chelipeds pinkish cream except for blue mesial and proximomesial area of propodus. Upper surfaces of legs pinkish cream basally; merus suffused with pale green; carpus olive green; remaining podomeres fading distally to pinkish cream; joints between ischium and merus and merus and carpus marked with bright orange, as are hooks on

ischiopodites of third pereiopods. Third maxilliped and lower surfaces of legs mostly cream; epistome largely cobalt blue but with cream splotches and margins. Ventral surfaces of abdomen, uropods, and telson pale blue; pleopods pinkish cream except for longitudinal cobalt blue bar on caudal surface of shaft of endopodite of second.

Type-locality: Boggy area below seepage along a small tributary to Turnbull Creek (Harpeth-Cumberland drainage system), one mile west of Kingston Springs, Cheatham County, Tennessee. There, along a shaded area adjacent to the stream, the watertable is virtually at the surface, and the ground, literally riddled with crayfish burrows, is almost covered with mats of liverworts and mosses. A shallow layer of soil, small rocks, and gravel overlies almost horizontally bedded rock, making it unnecessary, and probably impossible, for the crayfish to construct burrows to a depth greater than 1.5 feet.

Disposition of Types: The holotypic male, form I, the allotypic female, and morphotypic male, form II, are deposited in the Smithsonian Institution (nos. 130283, 130284, and 130285, respectively) as are the paratypes, which consist of 2 ♂, form I; 7 ♂, form II, 22 ♀; and 1 juvenile ♂.

Size: The largest specimen, a male, form I, has a carapace length of 48.3 mm, the largest female, 43.4 mm, and the smallest first form male, 30.8 mm. The former two specimens were collected from the Concord Creek, Rutherford County locality, and the latter from the type-locality.

Specimens Examined: TENNESSEE—Cheatham County: Type-locality, 1 ♀, G. Gentry, IV/1968; 1 ♂ I, 2 ♂ II, 3 ♀, G.G., XI/8/1968; 2 ♂ II, 2 ♀, G.G., XII/22/1968; 2 ♂ I, 6 ♂ II, 18 ♀, 1j ♂, G.G., D.J.P., J.E.P., H.H.H., IV/8/1969. Davidson County: Along creek adjacent to Park Office in Montgomery Bell State Park, 2j ♀, D.J.P., J.E.P., H.H.H., IV/10/1969. Houston County: Along Yellow Creek at Dickson County line on Tenn. Rte. 49, 1 ♂ II, D.J.P., J.E.P., H.H.H., IV/10/1969. Maury County: Near Mt. Pleasant, 1 ♂ I, 1 ♀, Bruce Cole, V/13/1969. Rutherford County: Along Concord Creek, off Tenn. Rte. 99 between Rockvale and Eagleville, 1 ♂ I, 3 ♀, H.N.M., V/1969; (?)"Tributary of Stone River, 20 miles from Columbia, 3 ♂ I, V.B., XI/189?." Williamson County: Camp Mary Mount, 22 miles W. of Nashville, 0.5 mile off Tenn. Rte. 100, 1 ♂ I, G.G., X/4/1969.

Thus the known range of the species encompasses portions of the basins of the Cumberland (Stones River, Harpeth River, and Yellow Creek) and Duck rivers in Middle Tennessee.

Variations: The only variations observed that are worthy of note exist in the specimens from the Concord Creek and "Stone River" localities in Rutherford County. The four individuals from the former are larger than those from the other localities, having carapace lengths of 40.7 to 48.3 mm of which the areolae constitute 43.5 to 44.5 percent, whereas, elsewhere the largest individual is a male from Stone River

with a carapace length of 37.8 mm, and the largest from the type-locality is a female measuring 35.3 mm. The areolae of the specimens from the latter two localities range from 42.4 to 44.0 and 40.4 to 43.2 percent of the carapace length, respectively.

The first pleopods of the male from the Concord Creek locality also differ from those in other localities in that the central projection is not so strongly recurved, the mesial process terminates in three or four small spines, and its distal portion is more strongly arched laterally than in the other males. Whether or not these variations in the pleopod are peculiar to the single male cannot be ascertained until additional specimens from the area become available. That the population of which it was a part attains a greater size than does that in the type-locality seems highly probable, for among the 37 specimens from the latter, none is as large as the smallest of the four specimens from the Concord Creek area.

Among the specimens from "Stone River," the constricted distal portion of the mesial process of the first pleopod is longer and more flattened than that of specimens from the vicinity of the type-locality, and the distal portion of the pleopod is almost as strongly arched laterally as it is in the single male from Concord Creek; however, the central projection is disposed more nearly like that in individuals from the type-locality.

Life History Notes: First form males have been collected in April, May, and November. Neither ovigerous females nor ones carrying young have been observed.

Relationships: Cambarus gentryi has its closest affinities with the members of the subgenus *Jugicambarus* (see Hobbs, 1969), and both in its morphology and habits seems to be more closely allied to *Cambarus carolinus* Erichson (1846:96) than to any other described species. Its most distinctive features are the linear areola and the cobalt blue carapace with orange or yellow markings.

Etymology: It is a pleasure to name this crayfish in honor of my good friend, Dr. Glenn Gentry, who has aided me on many occasions in my study of the crayfishes in Tennessee.

Remarks: In the type-locality, the crayfishes are deterred in their vertical burrowing by the shallow soil overlying bed rock, and as Dr. Gentry pointed out to us, the animals were more easily secured by utilizing a garden rake than a shovel. In other localities, they were either collected with the aid of a flashlight at night when they were at the mouths of their burrows or were walking on the surface of the ground, dug from complex burrows, or supposedly taken in a stream (by Von Baer).

In the type-locality, the burrows consisted of shallow, mostly horizontal passages, some six or eight feet in length, that branched and had two or three openings to the surface. Elsewhere, the burrows, while branching and having at least two openings to the surface, were more nearly vertical, with one passageway descending to a depth of about

three feet. Heavy rains had fallen shortly before the burrows were excavated, and the water table was within one foot of the surface.

Perhaps, like *Cambarus diogenes diogenes* Girard (1852: 88), the first form males occasionally leave their burrows and wander into streams. This possibility seems probable if we may assume that Von Baer collected his specimens from the stream bed, and the fact that all three specimens are first form males again lends further support to such a conclusion.

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